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Research Regarding the Use of Natural Predators for the Control of Pests for Pepper in Protected Culture

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Abstract

The experiment was conducted in solarium, in a pepper culture, using 2 hybrids: Red Night F1 for bell pepper and Kaptur F1 for long pepper. During the experiment, the influence of biological combat with natural predators and of chemical combat over the pepper production was observed, as well as plant reaction to management systems with 2 and 3 offshoots. Biological combat was made by introducing 3 times natural predators: first introduction 10 days after planting, to combat trips with Thripor-l with 500 insects of *Orius laevigatus*, the second one 14 days since the first, with Thripor-l with 500 insects of *Orius laevigatus* and half bottle of Swirski-mite with 25000 insects of *Amblyseius swirskii* and the last one 50 days since planting with Spidex with 2000 insects of *Phytoseiulus persimilis* to combat the spider (*Tetranychus urticae*). The results obtained showed that the best results were obtained from biological combat with natural predators for both pepper varieties. Regarding the number of offshoots, long pepper is more suitable for 2 off shoots management, while bell pepper for 3 offshoots management. Production per square meter (sqm) varied between 9.52 kg and 11.98 kg.

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Keywords: pepper, biological combat, chemical combat, solarium.

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1. Introduction

Protected areas for vegetable culture ensure favorable conditions for installing pest such as: mites, trips, aphids, white fly, tomato fruit mining moth, etc. As a result of the attacks of these pests, the plants suffer various morpho-physiological and biochemical modifications, influencing considerably the production capacity and harvest quality, but the using the bio fertilizers ensure a good tolerance at pests (Vlahova V., Popov V. 2014). In this context, possibilities to combat the Californian trips (*Frankliniella occidentalis* Perg.) and common red mite (*Tetranychus urticae* Koch) through biological methods were studied. Biological combat with the use of zoophages can be made by using predators, biopesticides and parasites that are domestic or imported from other countries (Fatu A.C., 2015, Hoza Gh., 2001, Dobrin I., 2008).

The red mite (*Tetranychus urticae* Koch – Acari - *Tetranichidae*) installs on pepper cultures from the moment of planting and can stay until harvest. The adults colonize the lower part of leaves and the floral buttons, the presence of the pest being manifested through discoloring of the leaves and floral buttons, resulting in their abortion (Pasol P. et al., 2007). Young pepper plants has a low resistance to the attacks of mites, a high density of pests leading to compromising the culture (Coss - Romero and Pena, 1998; Jovicich et al., 2009). Using the species *Phytoseiulus persimilis* Athias-Henriot (Acari- *Phytoseidae*) in combating the red mite reduces the attack on the culture, ensures healthy products and reduces the expenses with plant protection.

The Californian trips (*Frankliniella occidentalis* Perg. Thysanoptera –*Thripidae*) is a polyphagous specie that attack numerous vegetable and floral plants, their number being different enough by authors: 500 species of plants out of 50 botanical families (Georgescu M., 2006), Roman (1999, 2005b) and about 240 plants, Perju (2004).

Adults and larvae colonize the leaves, the vegetative tops, flowers, and fruit and suck the sap out of tissues. As a result of an attack, discoloring spots appear, which in time become silver or brown. Floral buttons that are attacked do not open anymore. Large attacks lead to reduced productions, with low quality, the damages going up to 80% of production (Zepa-Coradini, 2010).

The Californian trips are known as active vector in transmitting the TSWV virus to tomatoes and other species (Broadbent et al., 1986). The use of some predators in combating this pest in protected areas reduces the degree of attack on plant and increases product quality. *Orius laevigatus* (*Hemiptera – Anthocoridae*) is a predator that feeds with Californian trips adults and larvae, reducing its populations in vegetable and flower culture from protected areas.

The species *Amblyseius swirskii* (Athias - Henriot) (Acari: *Phytoseiidae*) is frequently used to combat Californian trips and other species of pests specific to vegetable culture in protected areas (Messelink et al 2006, 2008), currently being widely used in sweet pepper cultures from south-east Spain. Research made in Turkey on a pepper culture in heated and not heated tunnels showed that using *Amblyseius swirskii* 50 adults/sqm controlled the trips attack, even on the long term (Halil Kutusi et al., 2011).

Recently, also in Romania it was created an opportunity on the food market, especially vegetable market, by the demand for healthy products, which is why more and more vegetable growers use these methods to combat pests. It can be noticed the interest for biological products of the owners of small areas, family gardens meant for consumption, the production on these areas being made by protecting the environment and reducing the expenses with plant protection products (Stoian L., 2005).

2. Materials and Methods

2.1. Experimental design

The experiment was conducted within the vegetable area of Matca, Galati County, in a solar, with a culture of bell pepper and long pepper. The preparation of the soil was made by mobilization of soil, fertilization with organic fertilizer 58 t/ha, Complex 580 kg/ha and disinfecting it with Vertimec 0.2 % and Dithane M 45 0.4 %.

The biological material used was a hybrid of each type of pepper: Red Night F1 for bell pepper and Kaptur F1 for long pepper. The culture was made with seedlings produced in warm solarium, produced according to the classical technology, which at planting had optimum quality features for this culture system, respectively: height of 20-25 cm for bell pepper and 25-28 cm for long pepper, 14–15 leaves and floral button at the top, 70 days old, thick strain, disease and pest free.

The planting was realized on stripes of 2 rows, 40 cm distance between rows, 100 cm between the stripes and 35 cm between plants on a row.

2.2. Crop management

Specific pepper maintenance works were applied, especially fertilization and irrigation. The irrigations was first made each 2-3 days, then with the growth of the plants and increase of temperature, daily amounts of water were applied (0.5 – 1 l water/plant), usually in the morning.

Pest control was made by 3 introductions of natural predators: the first one 10 days since planting, in order to combat the trips with Thripor-l containing insects of *Orius laevigatus,* 500 insects; the second one 14 days since the first introduction, performed with Thripor-l with 500 insects of *Orius laevigatus* and half bottle of Swirski-mite with 25000 insects of *Amblyseius swirskii;* the last one 50 days since planting, with Spidex with 2000 insects of *Phytoseiulus persimilis*to combat the spider (*Tetranychus urticae).* The plant management system was conducting the plants with 2 and 3 offshoots, in conditions of biological and chemical combat, and the following measurements were made: production per plant, production per sqm, production per size category, yield of useful fruit part, expenses with chemical and biological combat.

3. Results and Discussions

Primary data processing showed that differences between hybrids, plant management systems and pest combat methods were recorded. For bell pepper, for the same plant management system, biological combat gave a production yield of 3.1 % in favor of biological protection. Comparing the plant management systems for the same protection method a production yield of 6.8 % was noticed, in favor of plant management system with 3 offshoots (table 1). For long pepper, comparative analysis of pest combat methods showed that for biological protection the production was slightly higher (1.1%). For the same pest combat method, plant management system gave a production yield of 1.03 %.

Pepper production per sqm was different between bell and long pepper managed with 2 and 3 offshoots, between biological and chemical combat.

Table 1. Productions obtained per plant for bell and long pepper

Bell pepper		
Chemical combat	Biological combat	
Production per plant (system with 2 offshoots)	Production per plant (system with 2 offshoots)	Production per plant (system with 3 offshoots)
2.53 kg	2.61 kg	2.79 kg
Long pepper		
3.10 kg	3.18 kg	3.07 kg

Thus, it was noticed that for bell pepper the production slightly increased from 9.52 kg/sqm for chemical combat, to 9.82 kg/sqm, for biological combat, the plants being managed with 2 offshoots.

In case of biological combat with 2 or 3 offshoots, a higher production of 10.5 kg/sqm was obtained for plants with 3 offshoots, compared to 9.82 kg/sqm obtained for plants with 2 offshoots.

For long pepper, the influence of pest combat method was weak, but in favour of biological combat. Plants with 3 offshoots produced less with 4% than plants with 2 offshoots (table 2).

Table 2. Production per sqm for bell and long pepper

Bell pepper		
Chemical combat	Biological combat	
Production per sqm (system with 2 offshoots)	Production per sqm (system with 2 offshoots)	Production per sqm (system with 2 offshoots)
9.52 kg	9.82 kg	10.50 kg
Long pepper		
11.67 kg	11.98 kg	11.51 kg

Fruit size for bell pepper was influenced by pest combat method. Classifying fruit after size showed a higher percentage (42-47%) for the 200-300g category, followed by the 100-200 g category. Analysing within the size category the influence of pest combat method and of plant management system, it was observed that plants with 2 offshoots, biologically protected had better results for the 200-300 g and over 300 g categories (figure 1).

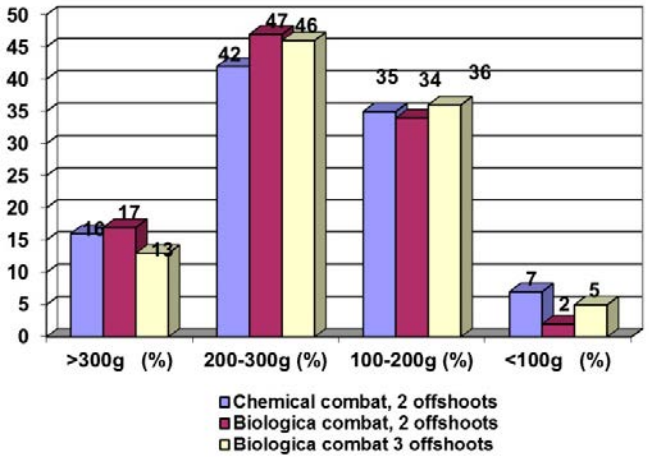

Fig. 1. Bell pepper production per size category (%)

For the long pepper, the highest fruit percentage was recorded for the 150-200 g category, for biological combat at plants with 3 offshoots, 42 %, even though from the production point of view it was lower. For the category over 200 g, better results were obtained for biological combat at plants with 2 offshoots (31%) compared to 23-26% obtained for the other systems within the same size class (fig.2).

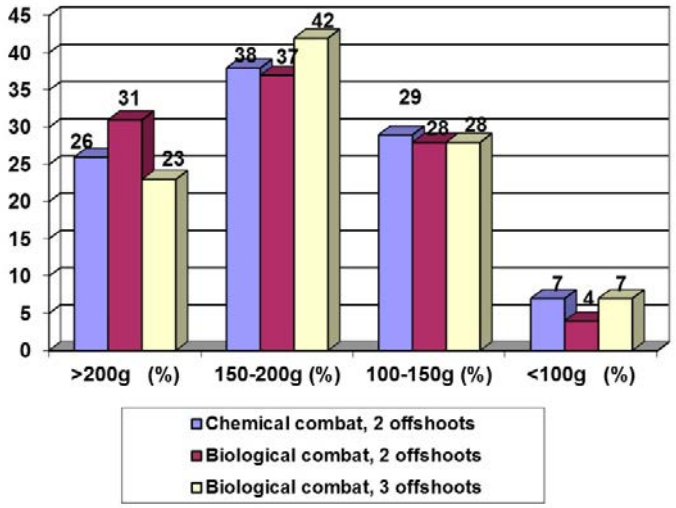

Fig. 2. Long pepper productions per size category (%)

Useful pulp yield was 89-90 % for both pepper varieties, without recording differences between pest combat variants.The cost with pest combat was higher for the chemical combat: 1429 lei/1000sqm, respectively 1.4 lei/sqm compared to 1112 lei/1000 sqm, respectively 1.1 lei/sqm for biological combat.

Pepper is a species attacked by pests, especially within protected areas, which is why the complexity of treatments and costs are higher (table 3).

Table 3. Costs with phyto-sanitary treatments for 1000 sqm

Biological combat		Chemical combat	
Predators	Costs (lei)	Pesticids	Costs (lei)
Thripor-l	626	Vertimec 1.8 % EC	188
Swirski-mite	280	Milbeknock EC	141
Spidex	153	Laser 240 SC	235
insecticid Teppeki	53	Actara 25 WG	129
-	-	Confidor Energy	59
-	-	Novadim Progress	59
-	-	Topsin AL 70 PU	71
-	-	Rovral 500 SC	106
-	-	Dithane M-45	47
-	-	Bravo 500 SC	82
-	-	Armetil Cobre	82
-	-	Teldor 500 SC	176
-	-	Ortiva 250 SC	53
Total	1112	Total	1429

Analysing the profit obtained as a result of applying biological combat with natural predators and managing the pepper plants with 2 and 3 offshoots, it was observed that the most efficient was the bell pepper with a profit of 7.21 lei/plant for 3 offshoot management and biological combat.

For the long pepper, the maximum profit was for 2 offshoot management and biological combat, 6.17 lei/plant (table 4).

Table 4. Costs and revenues per plant for bell and long pepper

Costs/ plant (lei)	Bell pepper					
	Chemical combat 2 offshoots		Biological combat 2 offshoots		Biological combat 3 offshoots	
	Revenue/pl. (lei)	Profit/pl. (lei)	Revenue/pl. (lei)	Profit/pl. (lei)	Revenue/pl. (lei)	Profit/pl. (lei)
6.01	11.52	5.51	12.01	6	13.22	7.21
	Long pepper					
	11.84	5.83	12.18	6.17	11.74	5.73

4. Conclusions

From this experiment regarding the influence of pest combat method and plant management system with 2 and 3 offshoots in case of bell and long pepper, the following conclusions can be drawn:

- The increase in fruit production per sqm for biological combat was higher for bell pepper plants with 3 offshoots and for long pepper plants with 2 offshoots;
- The increase in fruit production per plant for long pepper was higher for biological combat compared to chemical combat, for plants with 2 offshoots;
- Long pepper is more suitable for managing with 2 offshoots, while bell pepper for 3 offshoots, both in biological combat conditions;
- The increase in fruit percentage for the largest category was recorded for biological combat for both varieties of pepper, with values of 46-47 % for bell pepper and 37-42 % for long pepper;
- The profit was higher for both varieties for biological combat compared to chemical combat method.

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